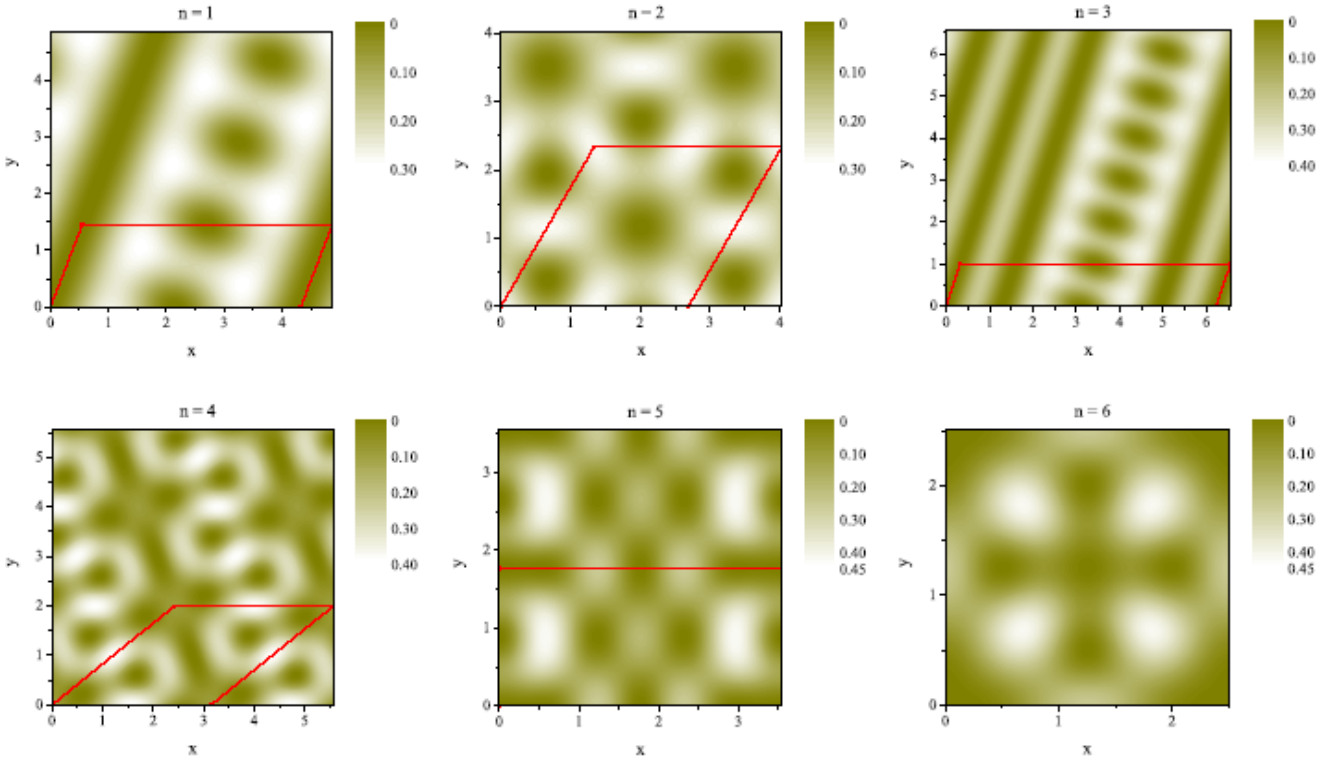
Vortex Lattice Structure of FFLO Superconductors

Kun Yang, Florida State University, DMR-0225698



Representative plots of the FFLO vortex lattice structure, which depends sensitively on the Landau level index n of the Cooper pair wave function. The appearance of high Landau level vortex state is a unique feature of FFLO superconductors, which can be used to pin down their presence . See cond-mat/0404580 for details.

The Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state is an exotic superconducting state whose order parameter carries finite momentum. It has remained elusive for 40 years until promising evidence for its existence in CeCoIn5 and several other organic and heavy-fermion superconductors started to emerge recently. We have studied the vortex lattice structure of the FFLO superconductor and found they are very different from the usual Abrikosov vortex lattice. We show that the vortex lattice structure can be used to pin down the presence of the FFLO state and measure its order parameter momentum.

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The work described in the previous page is an example of many research projects on condensed matter theory being pursued by the PI's group.

Other examples include:

- Physics of Quantum Hall edge states.
- Spin quantum Hall effect in unconventional superconductors.
- Phase diagram and excitation spectra of weakly coupled random spin chains.
- Magnetic transition in 1D metals.
- Disorder effect near 1st order phase boundaries in electronic system.

This grant has supported the research work and provided training opportunities to the following young physicists:

- Xin Wan, postdoc.
- Akakii Melikidz, postdoc.
- Denis Dalidovich, postdoc.
- Eddy Yusuf, graduate student; Ph.D expected 2005. Recipient of the Hellman-Dirac award for theoretical research at FSU.
- Qinghong Cui, graduate student; Ph.D. expected 2006.

Out-reach activities organized or participated by the PI:

- Saturday Morning Physics (weekly event for local high/middle school students).
- National High Magnetic Field Lab Annual Open House (for general public).